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REPORT FOR CONSULTATION ON THE METROPOLITAN MIAMI INTRASTATE AIR QUALITY CONTROL REGION (FLORIDA)

National Air Pollution Control Administration
Washington, D. C.

March 1970

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ON THE
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INTRASTATE AIR QUALITY CONTROL REGION
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U. S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service
Environmental Health Service

NATIONAL TECHNICAL
INFORMATION SERVICE

REPORT FOR CONSULTATION

ON THE

METROPOLITAN MIAMI

INTRASTATE AIR QUALITY CONTROL REGION

(FLORIDA)

Details of illustrations in
this document may be better
studied on microfiche.

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service
Environmental Health Service
National Air Pollution Control Administration

March 1970

I

PREFACE

The Clean Air Act, as amended, directs the Secretary of Health, Education, and Welfare to designate "air quality control regions" to provide a basis for the adoption of regional ambient air quality standards and the implementation of those standards. The Act stipulates that the designation of a region shall be preceded by consultation with appropriate State and local authorities. This report is intended to provide background information for a formal Consultation. It proposes boundaries for the Metropolitan Miami Intrastate Air Quality Control Region and discusses the factors which are the basis of the boundary proposal.

The Region* boundaries proposed in this report reflect consideration of available and pertinent information. However, the proposed boundaries remain subject to revisions suggested during the Consultation with State and local authorities. Formal designation of the Region will be made only after a careful review of all opinions and suggestions submitted during the consultation process.

The National Air Pollution Control Administration appreciates assistance received from the several agencies of the State of Florida including the Florida Air and Water Pollution Control Commission, the State Board of Health, the air pollution control

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*For the purposes of this report, the word "region", when capitalized, will refer to the proposed Metropolitan Miami Intrastate Air Quality Control Region.

agencies of Broward, Dade, and Palm Beach Counties, the Broward County Area Planning Board, the Metropolitan Dade County Planning Department, the Area Planning Board of Palm Beach County, and the Bureau of Economic and Business Research of the University of Florida.

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INTRODUCTION

THE REGIONAL APPROACH

Air pollution in the urban areas of the United States is a regional problem which frequently extends across State and local governmental boundaries. Since air pollution problems are rarely confined to any single municipality or county, successful control requires coordinated planning, standard setting, and enforcement by the several political jurisdictions which share a common problem. To date, State and local governments across the Nation have only begun to develop a regional approach to air pollution control.

The Clean Air Act, as amended, provides a regional approach which depends upon coordination and cooperation among all levels of government; municipal, county, State, and Federal. To set in motion the machinery for regional air pollution control, the Department of Health, Education, and Welfare designates air quality control regions, issues air quality criteria, and publishes reports on control techniques. The region designation identifies those State and local jurisdictions which will be involved in a regional air pollution control effort. The air quality criteria indicate the extent to which various concentrations of air pollutants are harmful to health and damaging to property. The reports on control techniques provide information on the costs and effectiveness of various techniques for controlling air pollutant emissions.

After the Department of Health, Education, and Welfare completes these initial steps, State governments develop ambient air quality standards and plans for implementation of those standards for areas within air quality control regions. An air quality standard defines the desired limit on the concentration of a pollutant in the ambient air of the region. It represents the degree of air quality which the regional control program will attempt to achieve. An implementation plan is a blueprint of the steps which will be taken to insure achievement of the air quality standards within a reasonable time. The Governors have 90 days either from the time that they are furnished the criteria and control technology reports or from the time that a region is designated by the Department of Health, Education, and Welfare - whichever occurs last - to submit letters indicating their intent to set standards. They have an additional 180 days to set the standards, and another 180 days to develop plans for implementing those standards. The procedure for setting standards includes a public hearing which allows residents of a region to express their views concerning desired standards.

The Department of Health, Education, and Welfare reviews air quality standards and implementation plans in order to ascertain their consistency with the provisions of the Act.

When air quality standards and implementation plans are approved, States proceed to prevent and control air pollution in

accordance with those standards and plans. This system for establishing a regional approach to air pollution control is outlined in Figure 1.

DESIGNATION OF AIR QUALITY CONTROL REGIONS

Designation of an air quality control region is one of the first steps in the regional approach to air pollution control. Section 107 (a) (2) of the Clean Air Act, as amended, directs the Secretary, Department of Health, Education, and Welfare to make such designations. The portions of the section relevant to this discussion state:

> "...The Secretary, after consultation with appropriate State and local authorities shall...designate air quality control regions based on jurisdictional boundaries, urban-industrial concentrations, and other factors including atmospheric areas necessary to provide adequate implementation of air quality standards. The Secretary may... revise the designation of such regions...The Secretary shall immediately notify the Governor or Governors of the affected State or States of such designation."

Procedure For Designation of Regions

Figure 2 illustrates the procedures used by the National Air Pollution Control Administration (NAPCA) to designate air quality control regions.

After evaluating relevant technical and urban factors, the National Air Pollution Control Administration publishes a proposed delineation of the region boundaries. At the same time NAPCA sets a time and place for a consultation meeting and distributes to State

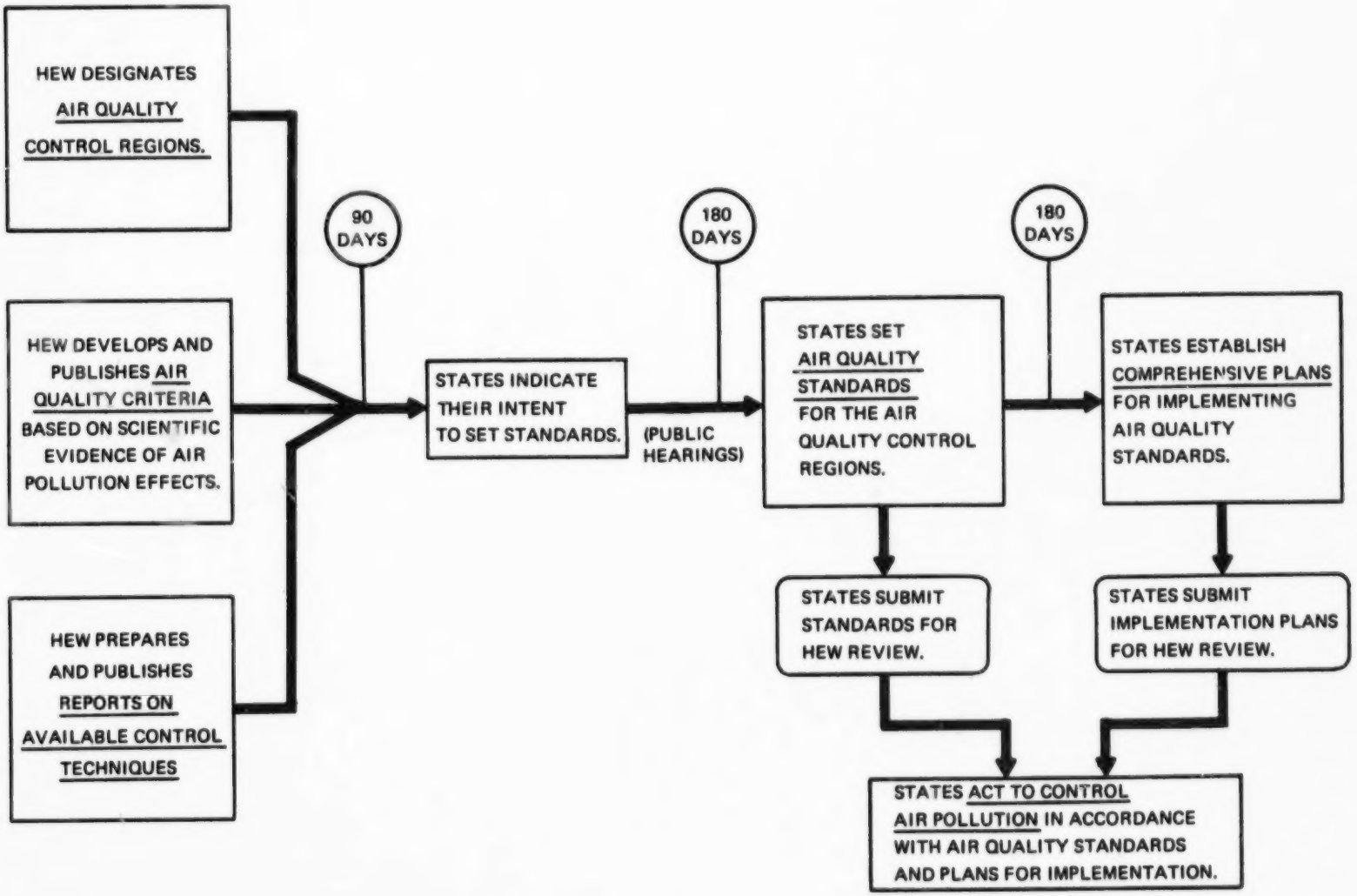
HEW DESIGNATES AIR QUALITY CONTROL REGIONS.
HEW DEVELOPS AND PUBLISHES AIR QUALITY CRITERIA BASED ON SCIENTIFIC EVIDENCE OF AIR POLLUTION EFFECTS.
HEW PREPARES AND PUBLISHES REPORTS ON AVAILABLE CONTROL TECHNIQUES
90 DAYS
STATES INDICATE THEIR INTENT TO SET STANDARDS.
180 DAYS
(PUBLIC HEARINGS)
STATES SET AIR QUALITY STANDARDS FOR THE AIR QUALITY CONTROL REGIONS.
180 DAYS
STATES ESTABLISH COMPREHENSIVE PLANS FOR IMPLEMENTING AIR QUALITY STANDARDS.
STATES SUBMIT STANDARDS FOR HEW REVIEW.
STATES SUBMIT IMPLEMENTATION PLANS FOR HEW REVIEW.
STATES ACT TO CONTROL AIR POLLUTION IN ACCORDANCE WITH AIR QUALITY STANDARDS AND PLANS FOR IMPLEMENTATION.

Figure 1 FLOW DIAGRAM FOR ACTION TO CONTROL AIR POLLUTION ON A REGIONAL BASIS, UNDER THE AIR QUALITY ACT.

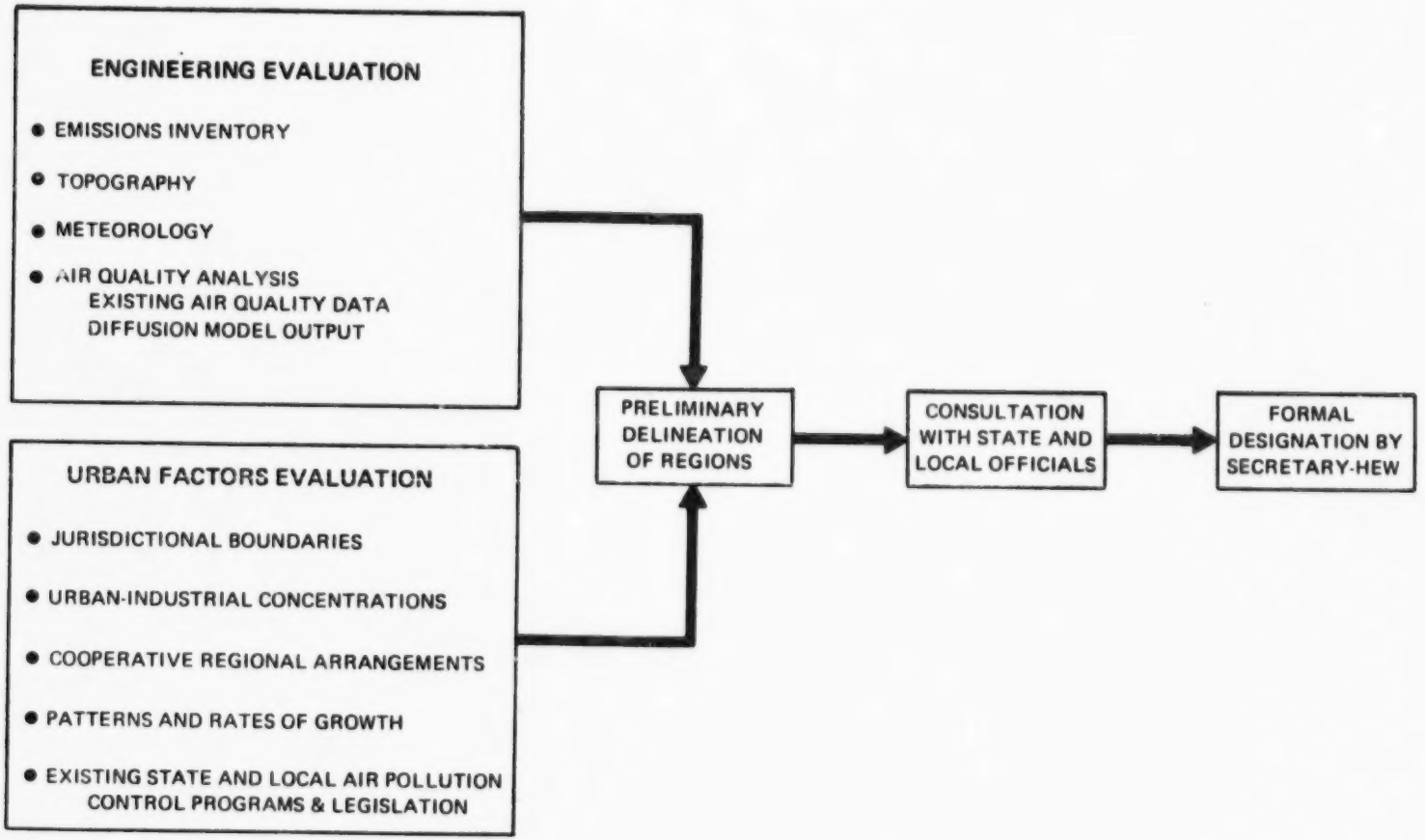
ENGINEERING EVALUATION
• EMISSIONS INVENTORY
• TOPOGRAPHY
• METEOROLOGY
• AIR QUALITY ANALYSIS
EXISTING AIR QUALITY DATA
DIFFUSION MODEL OUTPUT
URBAN FACTORS EVALUATION
• JURISDICTIONAL BOUNDARIES
• URBAN-INDUSTRIAL CONCENTRATIONS
• COOPERATIVE REGIONAL ARRANGEMENTS
• PATTERNS AND RATES OF GROWTH
• EXISTING STATE AND LOCAL AIR POLLUTION CONTROL PROGRAMS & LEGISLATION
PRELIMINARY DELINEATION OF REGIONS
CONSULTATION WITH STATE AND LOCAL OFFICIALS
FORMAL DESIGNATION BY SECRETARY-HEW

Figure 2. FLOW DIAGRAM FOR THE DESIGNATION OF AIR QUALITY CONTROL REGIONS.

and local authorities a report of the evaluation study (such as this "Report for Consultation") which includes the boundary proposal. At the consultation meeting State and local authorities are encourage to present fully their views and suggestions concerning the proposed boundaries of the region. Interested parties who do not have official status may submit comments in written form for the record. After careful review of all suggestions and opinions submitted for the record by interested parties, the Secretary of Health, Education, and Welfare makes a formal designation of the region boundaries and notifies the Governor(s) of the State(s) affected by the designation.

The Size of a Region

As stipulated in Section 107 (a) (2), the designation of air quality control regions should be based on "jurisdictional boundaries, urban-industrial concentrations, and other factors including atmospheric areas necessary to provide adequate implementation of air quality standards." This language suggests a number of objectives which are important in determining how large an air quality control region should be. Basically, these objectives can be divided into three separate categories.

First, a region should be self-contained with respect to air pollution sources and receptors. In other words, a region should include most of the important sources in the area as well as most of the people and property affected by those sources. In this way, all the major elements of the regional problem will lie within

one unified administrative jurisdiction. Unfortunately, since air pollutants can travel long distances, it is impractical if not impossible to delineate regions which are completely self-contained. The air over a region will usually have at least trace amounts of pollutants from external sources. During episodic conditions, such contributions from external sources may even reach significant levels. Conversely, air pollution generated within a region and transported out of it can affect external receptors to some degree. It would be impractical and inefficient to make all air quality control regions large enough to encompass these low-level trace effects. The geographic extent of trace effects overestimates the true problem area which should be the focus of air pollution control efforts. Thus, the first objective, that a region be self-contained, becomes a question of relative magnitude and frequency. The dividing line between "important influence" and "trace effect" will be a matter of judgment. The judgment should be based on estimates of the impact a source has upon a region, and the level of pollution to which receptors are subjected. In this respect, annual and seasonal data on pollutant emissions and ambient air concentrations are a better measure of relative influence than short term data on episodic conditions.

The second general objective requires that region boundaries be designed to meet not only present conditions but also future conditions. In other words, the region should include areas where

industrial and residential expansion are likely to create air pollution problems in the foreseeable future. This objective requires careful consideration of existing metropolitan development plans, expected population growth, and projected industrial expansion. Such considerations should result in the designation of regions which will contain the sources and receptors of regional air pollution for a number of years to come. Of course, region boundaries need not be permanently fixed, once designated. Boundaries should be reviewed periodically and altered when changing conditions warrant readjustment.

The third objective is that region boundaries should be compatible with and even foster unified and cooperative governmental administration of the air resource throughout the region. Air pollution is a regional problem which often extends across several municipal, county, and even state boundaries. Clearly, the collaboration of several governmental jurisdictions is prerequisite to the solution of the problem. Therefore, the region should be delineated in a way which encourages regional cooperation among the various governmental bodies involved in air pollution control. In this regard, the existing pattern of governmental cooperation on the whole range of urban problems may become an important consideration. Certainly the pattern of cooperation among existing air pollution control programs is a relevant factor. In general, administrative considerations dictate that governmental jurisdictions should not be divided. Although it would be impractical

to preserve State jurisdictions undivided, usually it is possible to preserve the unity of county governments by including or excluding them in their entirety. Occasionally, even this would be impractical due to a county's large size, wide variation in level of development, or striking topographical features.

To the extent that any two of the above three objectives lead to incompatible conclusions concerning region boundaries, the region must represent a reasonable compromise. A region should represent the best way of satisfying the three objectives simultaneously.

As noted above, the evaluation of relevant technical factors and urban factors forms the basis of the boundary proposals published by NAPCA. The evaluation of technical factors is designed to indicate, where possible, the location of pollution sources and the geographic extent of serious pollutant concentrations in the ambient air. The quantity, locations, and nature of air pollutant emissions are determined by conducting an inventory of the various pollutant generators in an area. The transport and distribution of pollutants in the ambient air are analyzed on the basis of measured air quality data, the location of emissions, meteorological data, and topographic information. A mathematical diffusion model, which predicts ambient pollution concentrations from information on emissions and meteorology, can be used in areas where irregular topographical features would not invalidate the theoretical model.

As a whole, the technical study indicates how large the air quality control region must be in order to encompass most pollution sources and most people and property affected by those sources.

The study of urban factors encompasses a different set of considerations. It reviews existing governmental jurisdictions, the location of urban and industrial concentrations, expected patterns of urban growth, cooperative regional arrangements, existing State and local air pollution control programs, and other associated factors. As a whole, the study of urban factors is designed to indicate how large a region must be in order to encompass expected regional growth and to encourage cooperation among political units in controlling air pollution.

The body of this report contains a proposal for the boundaries of the Metropolitan Miami Intrastate Air Quality Control Region and outlines the evaluation of technical and urban factors which was the basis of the proposal. The report is intended to serve as the background document for the formal Consultation with appropriate State and local authorities.

EVALUATION OF ENGINEERING FACTORS

POLLUTANT EMISSIONS INVENTORY

The compilation of an air pollutant emissions inventory makes possible the correlation of pollutant emissions with specific geographic locations. This procedure generally results in the determination of the "core" of an air quality control region--that is, the area where the bulk of the pollutant emissions occur. In this study, the emissions inventory results are further utilized as input data to a meteorological diffusion model to predict the dispersion patterns of the pollutants emitted in the atmosphere.

The emissions inventory for the Miami-Fort Lauderdale-West Palm Beach Study Area was conducted by the National Air Pollution Control Administration. The survey area, shown in Figure 3, included Broward, Dade and Palm Beach Counties. These three counties are each Standard Metropolitan Statistical Areas (SMSA's) whose combined 1970 estimated population is 2,332,000. These counties together account for the great majority of the population, urban development and industrial activity in southern Florida.

The Public Health Service rapid survey technique was used for the estimation of pollutant emissions. The emissions were calculated from data representative of the year 1968. Table I

FIGURE 3. EMISSIONS INVENTORY SURVEY AREA.

TABLE I. SUMMARY OF AIR POLLUTANT EMISSIONS IN THE GREATER MIAMI STUDY AREA, 1968 (TONS/YEAR).

		TRANSPORTATION		FUEL COMBUSTION IN STATIONARY SOURCES				REFUSE DISPOSAL			
	County	Motor Vehicles	Other	Industry	Steam—Electric	Residential	Commercial & Institutional	Incineration	Open-Burning	INDUSTRIAL PROCESSES	COUNTY TOTAL[1]
SULFUR OXIDES	BROWARD	1,200	2,400	N	57,400	80	N	460	10	N	61,600
	DADE	1,970	480	7,880	42,400	70	3,300	600	N	0	56,700
	PALM BEACH	770	620	2,780	27,700	100	420	80	30	N	32,500
	TOTAL	3,940	3,500	10,760	127,500	250	3,720	1,140	40	N	150,800
TOTAL PARTICULATES	BROWARD	2,100	600	N	1,700	N	N	2,400	160	N	7,000
	DADE	3,430	2,520	660	1,200	10	390	2,570	N	11,600	22,400
	PALM BEACH	1,350	300	250	810	10	120	400	450	34,900	38,600
	TOTAL	6,880	3,420	910	3,710	20	510	5,370	610	46,500	68,000
CARBON MONOXIDE	BROWARD	242,800	32,500	N	N	N	N	450	850	N	276,600
	DADE	484,400	40,700	40	N	N	30	550	N	N	525,700
	PALM BEACH	177,100	4,800	30	N	N	10	1,760	2,420	54,700	240,800
	TOTAL	904,300	78,000	70	10	N	40	2,760	3,270	54,700	1,043,100

[1] Rounded Totals
N= Negligible

Note: Field Burning of Sugarcane Included With Industrial Process Losses.

provides a county breakdown of sulfur oxide, total particulate and carbon monoxide emissions according to source type in four general categories. These categories are transportation, fuel combustion (stationary sources), refuse disposal and industrial processes. The information provided by Table I indicates that nearly 35% of all sulfur oxide emissions in the study area are attributable to steam-electric utilities. Industrial process losses account for about 68% of all total particulate emissions in the survey area. Approximately 87% of all carbon monoxide emitted in the study area is attributable to motor vehicles.

Sulfur oxides are emitted in greatest quantities in Broward County. Palm Beach County is responsible for the greatest contribution of total particulate emissions to the survey area. Dade County contributes the majority of the carbon monoxide emitted within the survey area. Significant quantities of all three major pollutants, however, are emitted in each of the three counties surveyed.

Source locations within the survey area were defined by grid coordinates based on the Universal Transverse Mercator (UTM) System. Figure 4 shows the grid system superimposed over an outline of the survey area. Grid squares 5 kilometers on a side were used in areas of greatest urban development, while grid zones 10, 20 and 40 kilometers on a side were used in less intensely developed areas. Figures 5, 6 and 7 present emission densities for

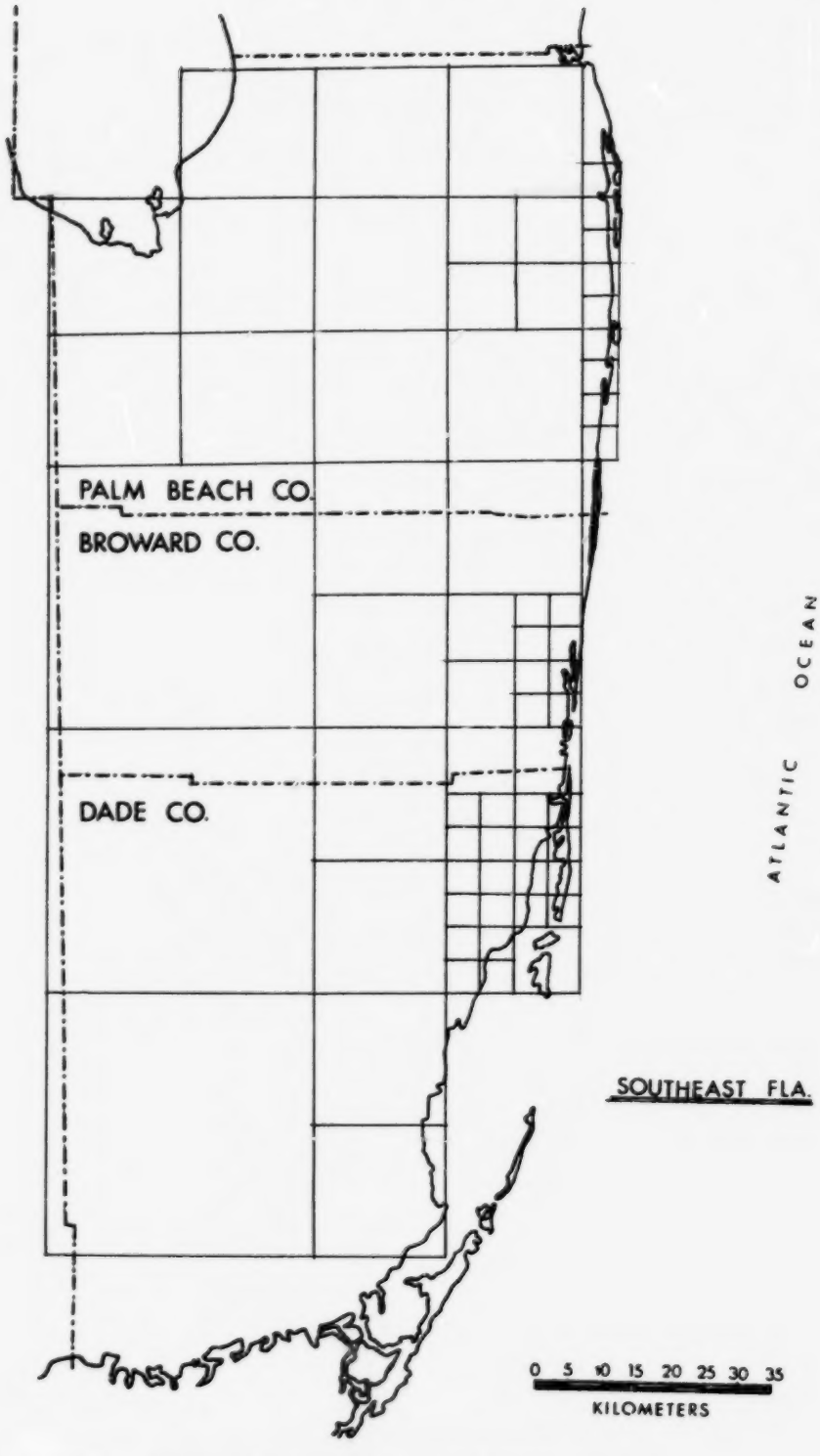

FIGURE 4. EMISSIONS INVENTORY GRID COORDINATE SYSTEM.

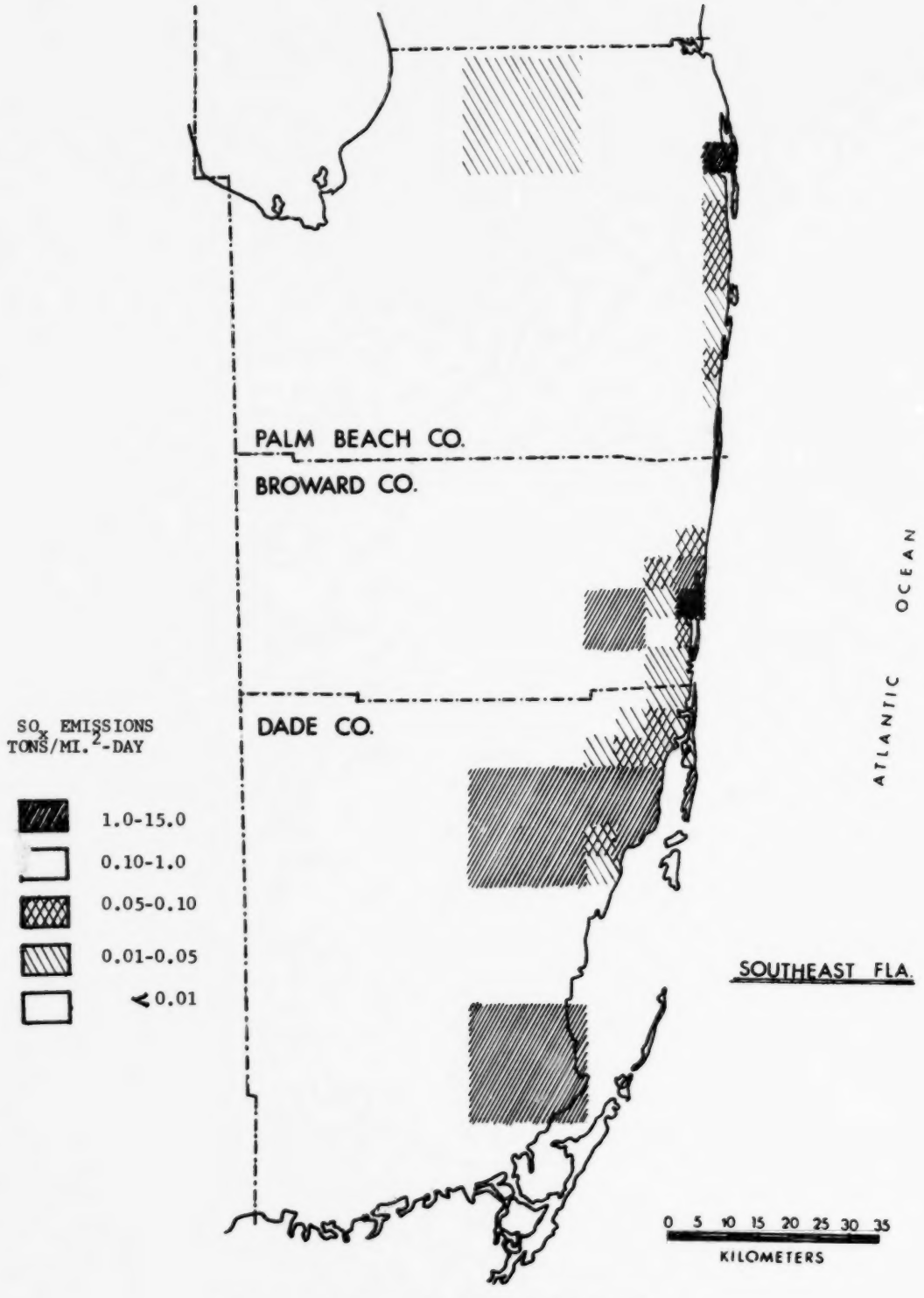

FIG. 5. SULFUR OXIDES EMISSION DENSITIES.

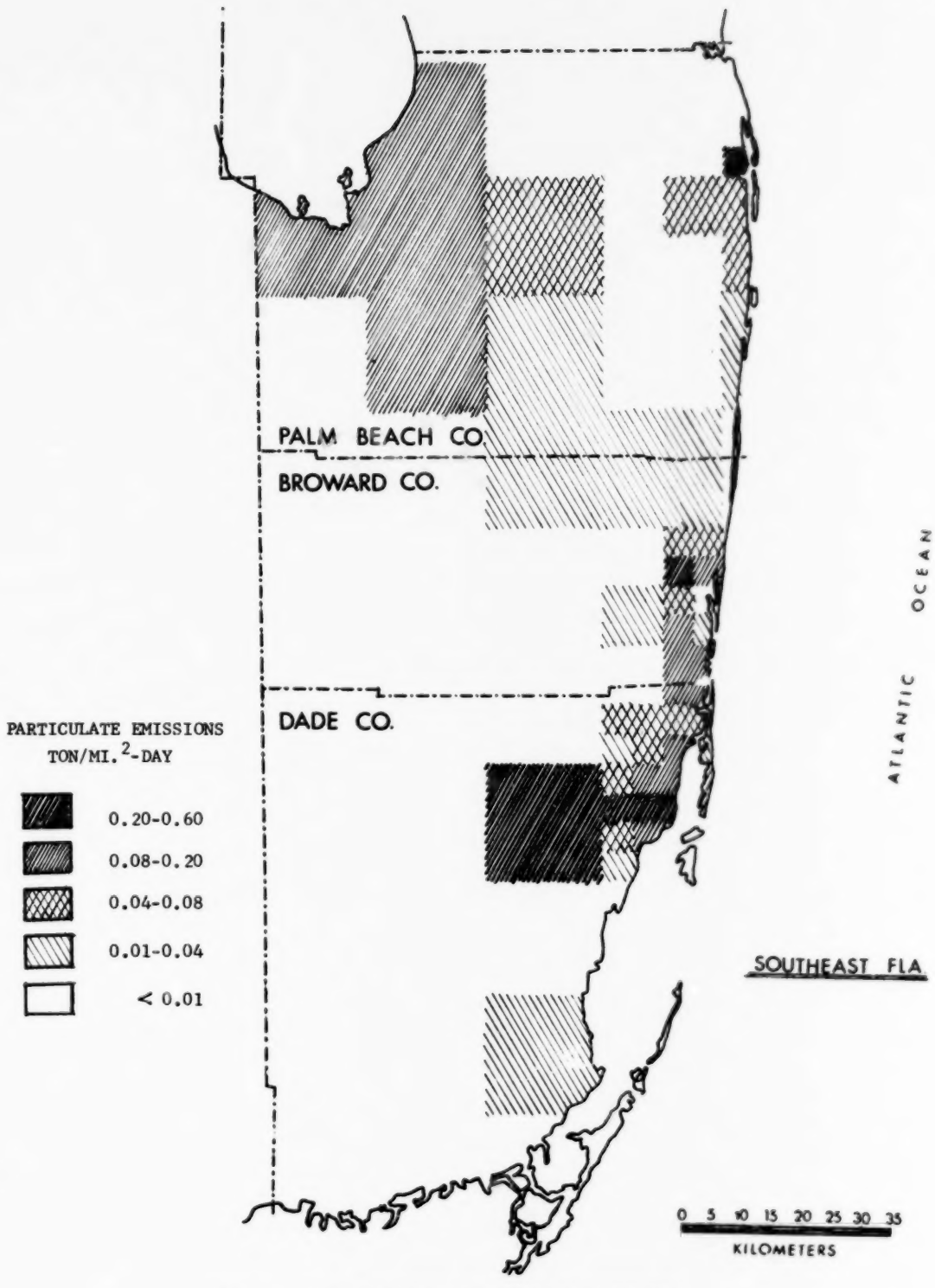

FIG. 6. TOTAL PARTICULATE EMISSION DENSITIES.

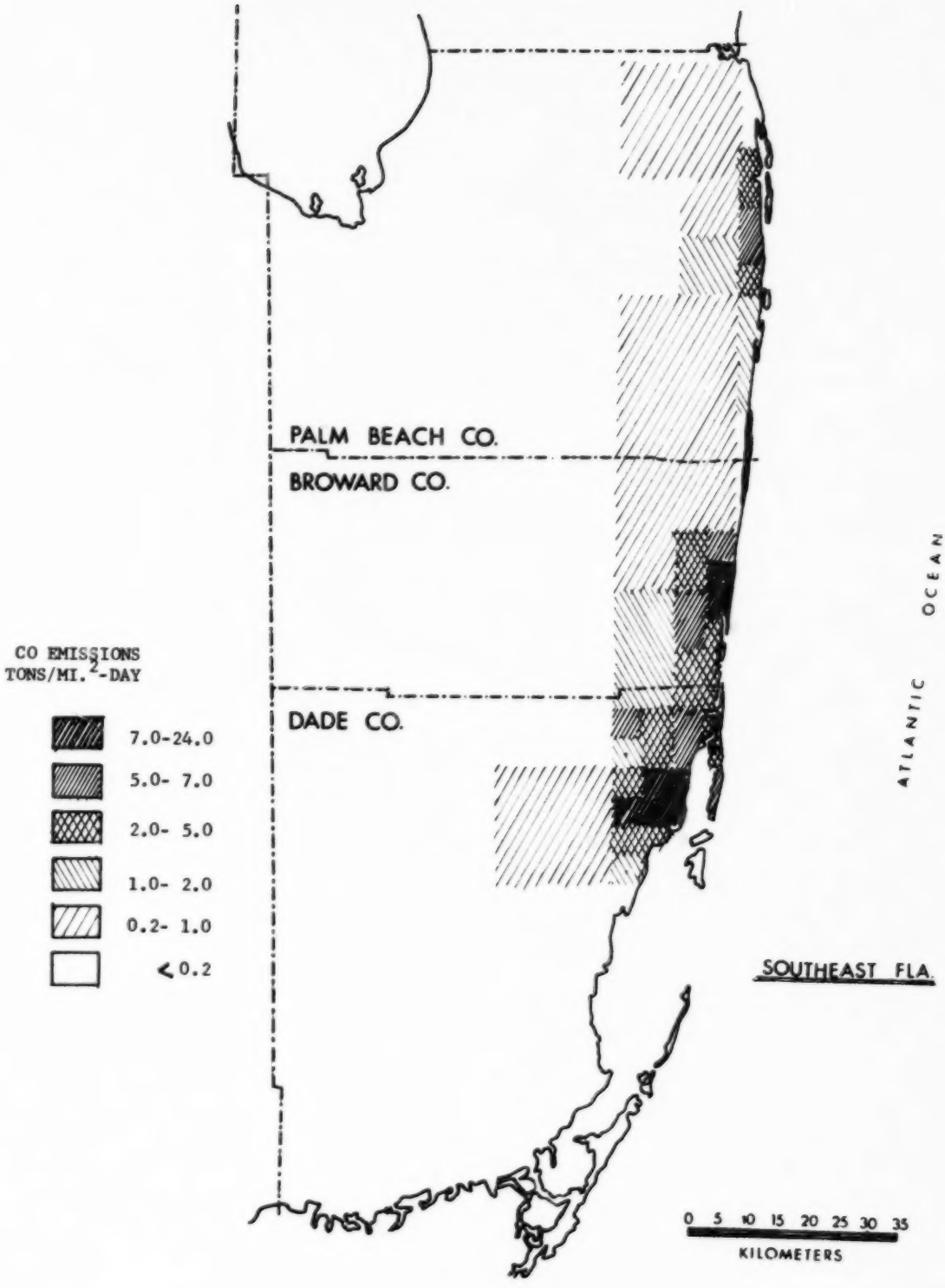

FIG. 7. CARBON MONOXIDE EMISSION DENSITIES.

sulfur oxides, total particulates and carbon monoxide, respectively, based on this grid system. Figure 8 shows the location of the major point sources in the study area.

The sulfur dioxide and total particulate emission density patterns reflect the location of major point sources and the urban coastal development pattern in southeastern Florida. The total particulate density pattern also reflects the existence of sugarcane field-burning activities in the western portions of Palm Beach County. Carbon monoxide emission patterns similarly reflect the location of urban development in the coastal areas where vehicular traffic intensity is greatest. The contributions of carbon monoxide by field-burning of sugarcane in western Palm Beach does not show up in Figure 7, however.

AIR QUALITY

Introduction

The regional approach to air resource management requires that those jurisdictions containing the majority of the sources of pollution in a metropolitan area be included within a single air quality control region. An air quality control region should also include jurisdictions containing the majority of the people and property adversely affected by air pollutant emissions from those same sources. The core area of a region can be roughly defined on the basis of pollutant point source locations and

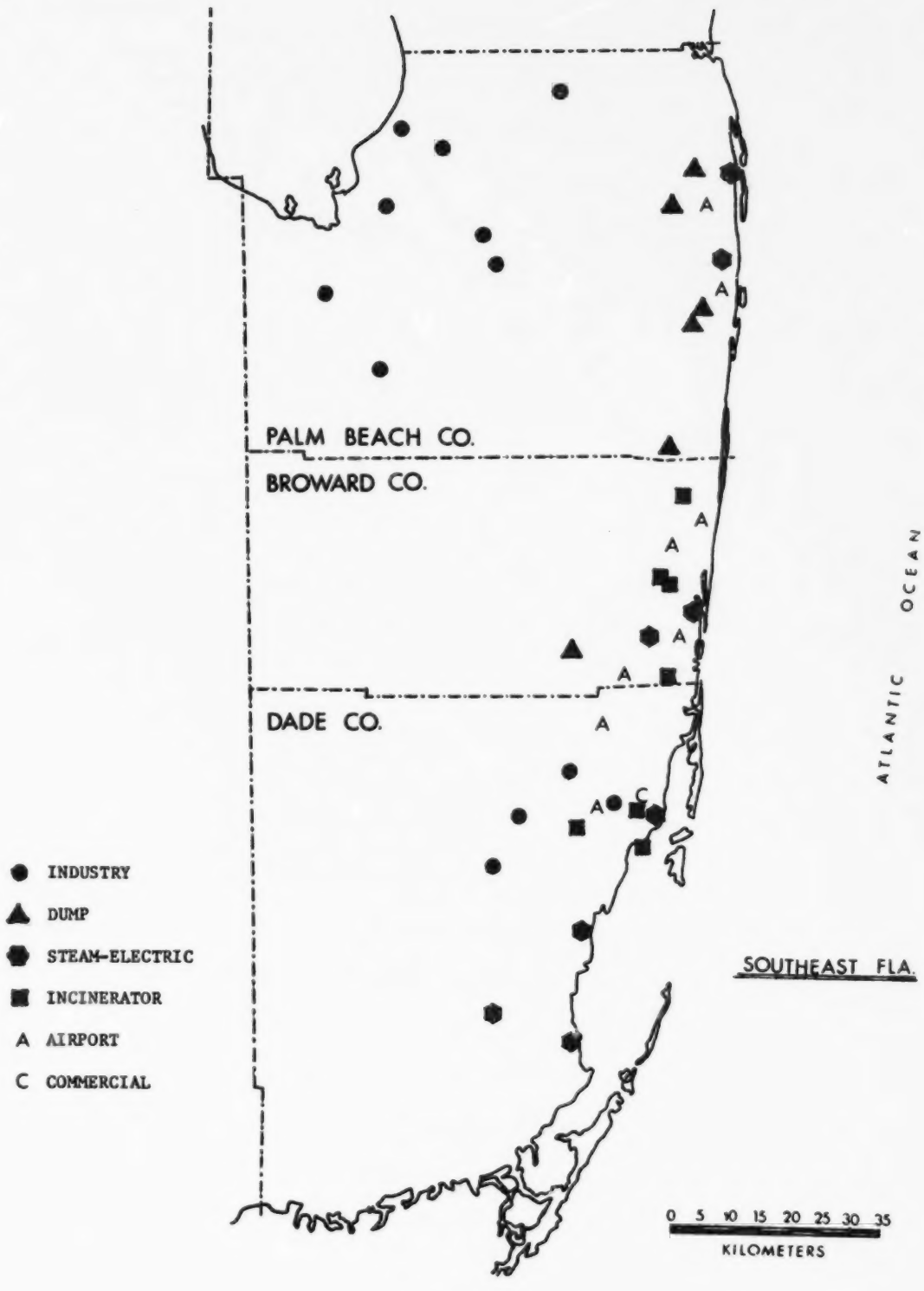

FIGURE 8. LOCATION OF MAJOR POINT SOURCES.

relative emission densities. However, information on present levels of pollution in the ambient air is helpful in order that peripheral pollutant receptor areas can be identified. The selection of an essentially self-contained region will result--a region which will include within its bounds virtually the entire source-receptor system for a particular area. By using this approach, the possibility of pollutant cross-boundary transport problems will be minimized.

The following sections discuss briefly the factors likely to affect air pollution potential in southern Florida. These factors are topography and meteorology. In addition, a brief discussion of existing air quality is presented. Finally, a description of the diffusion model which has been used to predict patterns of air pollutant dispersion in the study area, is presented.

Topography, Meterology and Measured Air Quality

Southern Florida forms a broad and nearly level plateau. Much of this plateau is part of a coastal lowland which extends inland from the coast for distances of between 10 and 125 miles. Elevations throughout southern Florida are low, while variations in elevation are small. The highest elevation in Dade County, for example, is only 22 feet above sea level. The majority of Dade County is less than 10 feet above sea level. The majority of Palm Beach County is only between 10 and 20 feet above sea

level. Much of the western portions of Dade, Broward and Palm Beach Counties, and large sections of Hendry, Collier and Monroe Counties are covered by the Glades area--a broad river which flows slowly south and southwest from Lake Okeechobee to the Bay of Florida. In summary, the topography in southern Florida does not restrict the dispersion of air pollutants due to its flatness. As a result, topography is not a factor which is helpful in determining Region boundaries.

Meteorology

The meteorology in southern Florida is generally favorable to the diffusion of air pollutants. Wind data accumulated at Miami International Airport is presented in Figure 9. The wind "roses" shown for the winter, summer and annual averaging times depict the relative frequency of occurrence of wind blowing from the 16 compass directions. Generally, winds from the easterly quadrants predominate at all times. The coastal areas are affected more by these easterly sea breezes than the inland areas. East-southeast winds prevail during the months of February through September. East-northeast winds predominate during October, while north winds occur most frequently from November through December. North-northwest winds prevail during January. Average wind speeds in southeast Florida are the highest in the State and aid greatly in the dispersion of pollution. The coastal areas of southern

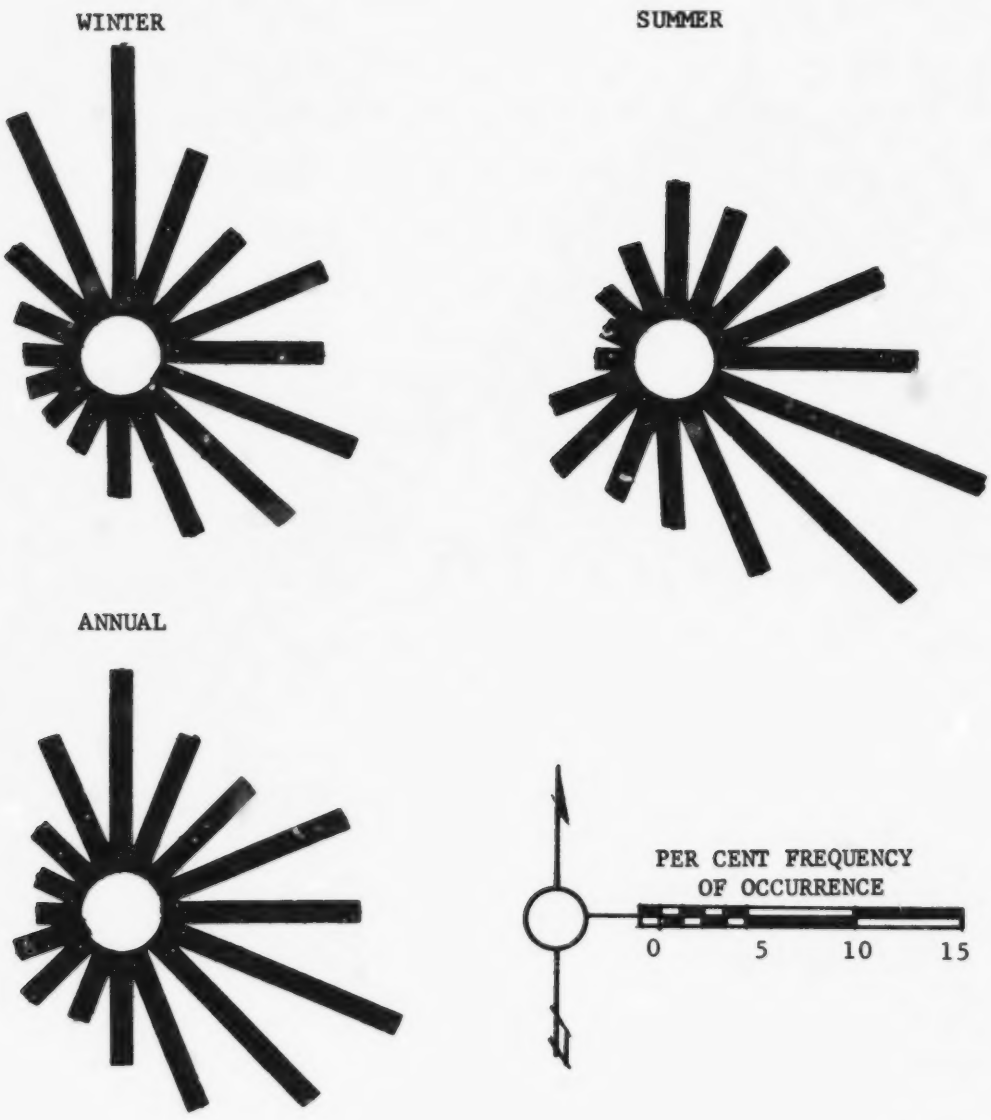

FIGURE 9. WIND DIRECTION PER CENT FREQUENCY OF OCCURRENCE FOR VARIOUS AVERAGING TIMES.

Florida have relative few calms and small temperature differences between day and night. These factors further tend to minimize air pollution.

Morning and afternoon average mixing depths for various averaging times are presented in Table II. Mixing depths provide a measure of the volume within which pollutants may mix without restriction. Pollutant dilution is most restricted during the mornings. Dilution is least restricted during summer afternoons. Inversions in southern Florida occur only as a result of the diurnal cycle and not as a result of irregular topography. Long term inversion periods are rarely encountered in the study area, and occur less often than in any other area in the nation. No forecast high air pollution potential days (air pollution episodes) occurred in the study area between August 1, 1960 and August 31, 1969.

TABLE II. AVERAGE MIXING DEPTHS BY SEASON AND TIME OF DAY (METERS)

Season	Morning Average	Afternoon Average	Average Morning & Afternoon
Winter	655	1210	935
Summer	1040	1360	1200
Annual (4 seasons)	880	1330	1105

The Dade County Pollution Control Department maintains an ongoing program of air quality surveillance. Sampling is conducted for sulfur oxides, carbon monoxide, nitrogen oxides, particulate matter and oxidants. Data for SO_2, CO, suspended particulates and dustfall are presented in Table III. In general, SO_2 and CO levels are relatively low in Dade County. Suspended particulate concentrations recorded in Miami are lower than those found in most other cities of the same or smaller population classes, based on National Air Surveillance Network (NASN) data. The suspended particulate concentrations are, however, substantially greater than levels recorded at a non-urban site in Key Largo (Monroe County). The geometric mean concentration at this site was 26 $\mu g/m^3$ for the years 1958 through 1964. This value might be considered as a measure of the natural or "background" level of suspended particulates in the study area.

During 1966 and 1967, a county-wide air pollution study was conducted by the Palm Beach County Health Department. Dustfall levels recorded in 8 cities along the coast averaged 10.5 tons/mi^2-month. The maximum dustfall level recorded was 28.2 tons/mi^2-month at Delray Beach. Dustfall levels at Royal Palm Beach, a buffer zone between the urban coastal area and the glades, averaged 6.0 tons/mi^2-month, with a maximum of 9.2 tons/mi^2-month. Dustfall levels in the Pahokee-Belle Glade portion of Palm Beach County averaged 16.5 tons/mi^2-month (March and April 1966 only), with

TABLE III. DADE COUNTY MEASURES AIR QUALITY***

		1966	1967	1968
Sulfur Dioxide	Ave.	.000	.000	.000
	Max.	.002	.003	.004
Carbon Monoxide	Ave.	1.00	0.80	0.90
	Max.	1.58	2.20	2.50
Suspended Particulates ($\mu g/m^3$)	Ave.	58.5	54.9	52.6
	Ave. Max.	63.7	68.6	68.8
		1957-1963 NASN DATA FOR MIAMI: 56 $\mu g/m^3$ geometric mean. 1965-1967 NASN DATA FOR MIAMI: 51 $\mu g/m^3$ geometric mean.		
Dustfall Tons/Mi^2-Month	Ave.	11.4*	11.8*	9.8*
		—	—	17.2**
	Ave. Max.	15.9*	18.9*	8.8*
		—	—	14.0**

* 8 Dade County Stations
** 7 Miami Beach Stations
*** Metropolitan Dade County Pollution Control Department

a maximum of 22.4 tons/mi^2-month. These high levels were related to sugarcane field-burning activities. Suspended particulate concentrations averaged 42 $\mu g/m^3$ at 5 coastal sites, 77 $\mu g/m^3$ in Pahokee-Belle Glade, and 22 $\mu g/m^3$ in Royal Palm Beach. Maximum concentrations recorded in these 3 county sub-areas were 184, 128 and 32 $\mu g/m^3$, respectively.

Levels of suspended particulates recorded in Fort Lauderdale during 1964 indicates a geometric mean concentration of 34 $\mu g/m^3$, and a maximum of 57 $\mu g/m^3$.

Diffusion Model Results

A meteorological diffusion model has been used to compute mathematically, ground-level concentrations of sulfur oxides, carbon monoxide and suspended particulates at specified receptor points. Long-term average concentrations are predicted following a mathematical treatment of air pollutant emissions and meteorological data. The diffusion model neglects topographical features for area-source emissions and receptor points, and assumes an effective stack height of 75 meters for all point sources. While this, and other limitations are inherent to the model, it nevertheless has merit in providing reasonable spatial distributions of long-term (seasonal and annual) average pollutant concentrations.

Figure 10 presents computed relative sulfur oxide concentrations for the summer averaging time. The highest relative concentrations

are computed to occur in and near the power plants responsible for the majority of the sulfur oxides emitted in the survey area. The combined impact of all SO_x emissions is to affect in varying degrees the air quality over large portions of the intensely urbanized coastal areas of Dade, Broward and Palm Beach Counties.

Figure 11 presents computed relative concentrations of carbon monoxide for the winter averaging period. Greatest concentrations are computed to occur over the Miami urban complex. Much of the remainder of northeast Dade County and eastern Broward County also experience relatively high concentrations of CO, according to the model. The dispersion pattern for CO is in close agreement with the pattern of carbon monoxide emissions in southeastern Florida.

Computed relative concentrations of suspended particulates for the summer averaging period are shown in Figure 12. The dispersion pattern reflects the location of major point sources and urban development in southeastern Florida. The impact of major point sources on ambient air quality is particularly noticeable in western Palm Beach County.

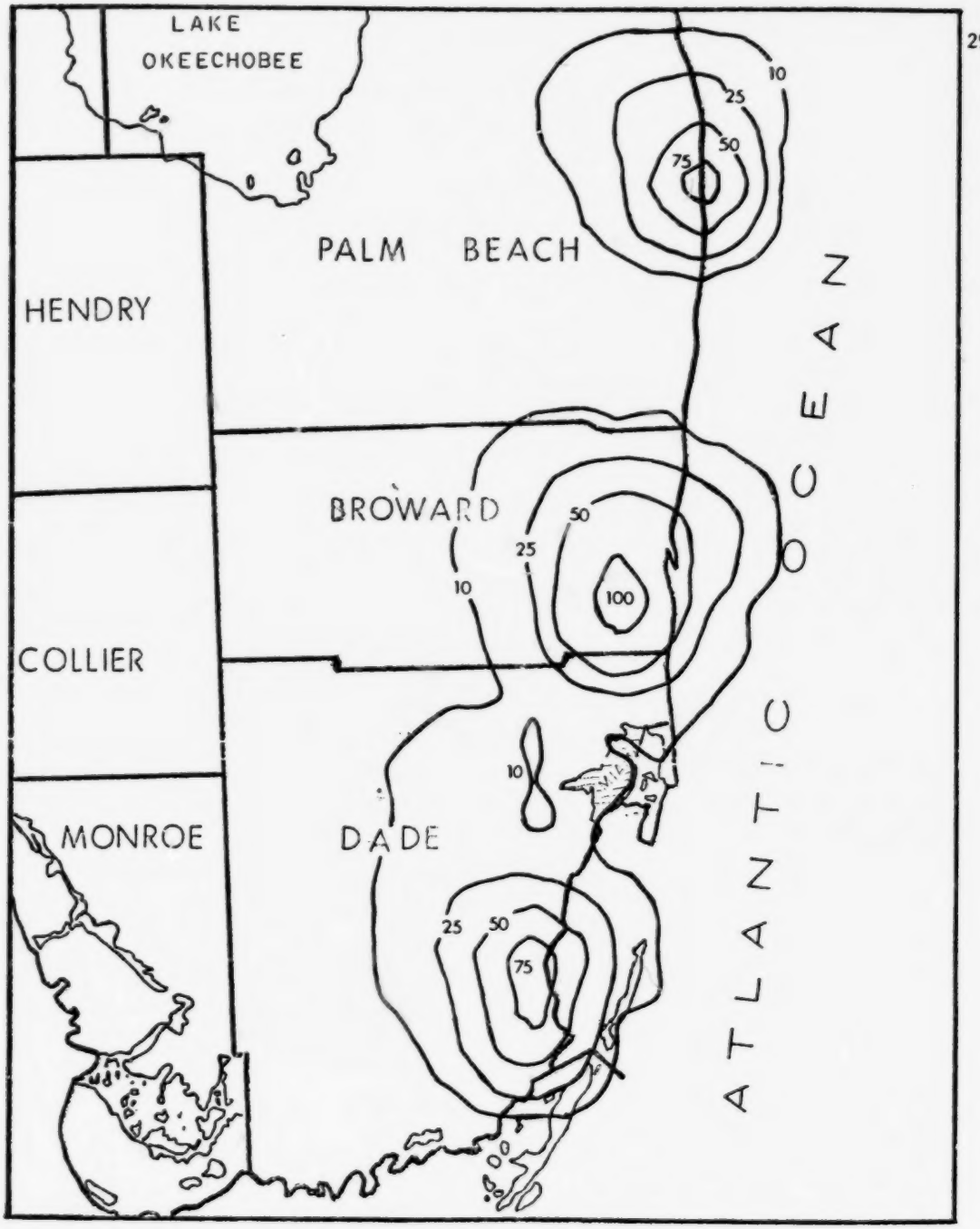

FIGURE 10. COMPUTED RELATIVE CONCENTRATIONS OF SULFUR OXIDES (SUMMER AVERAGE).

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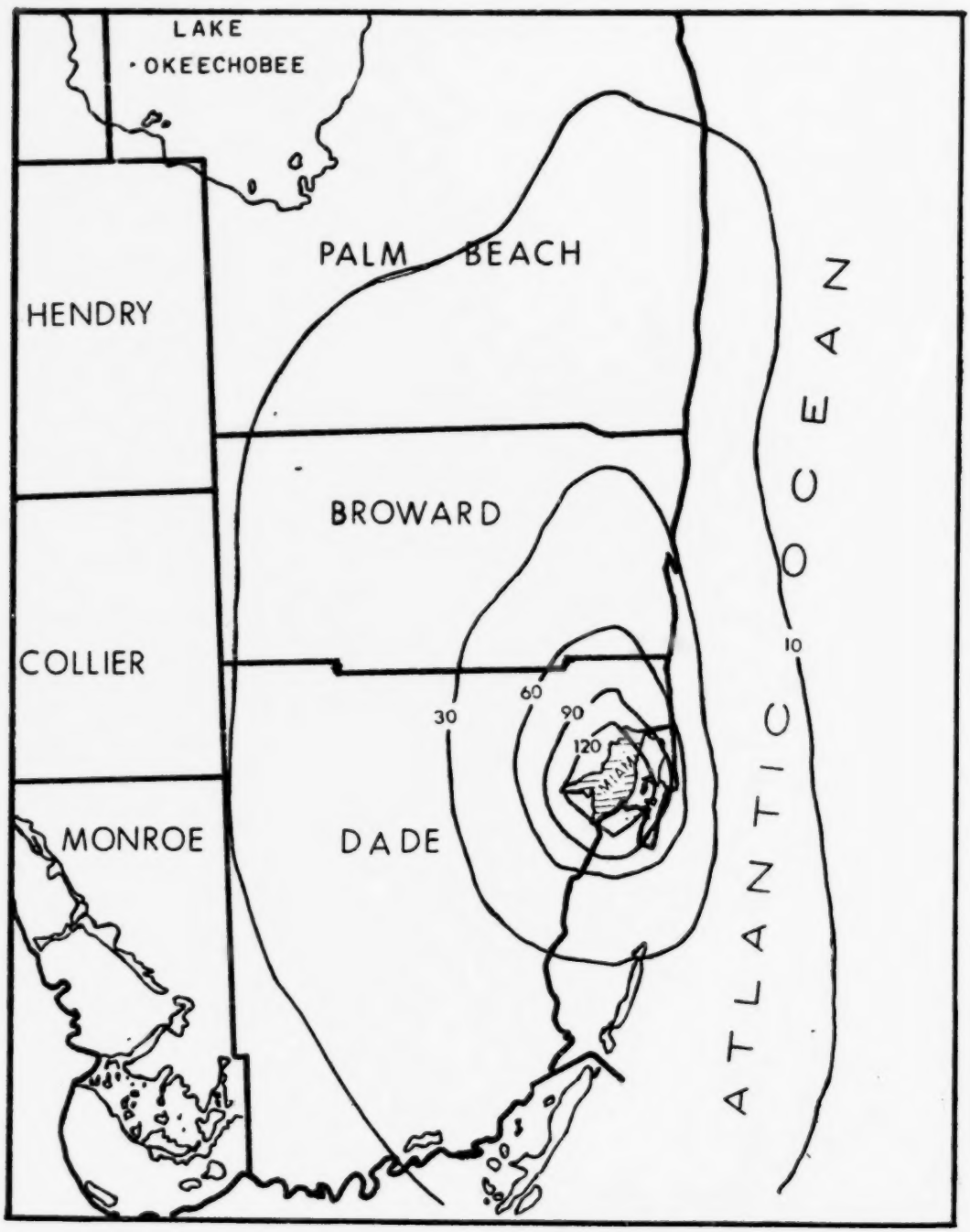
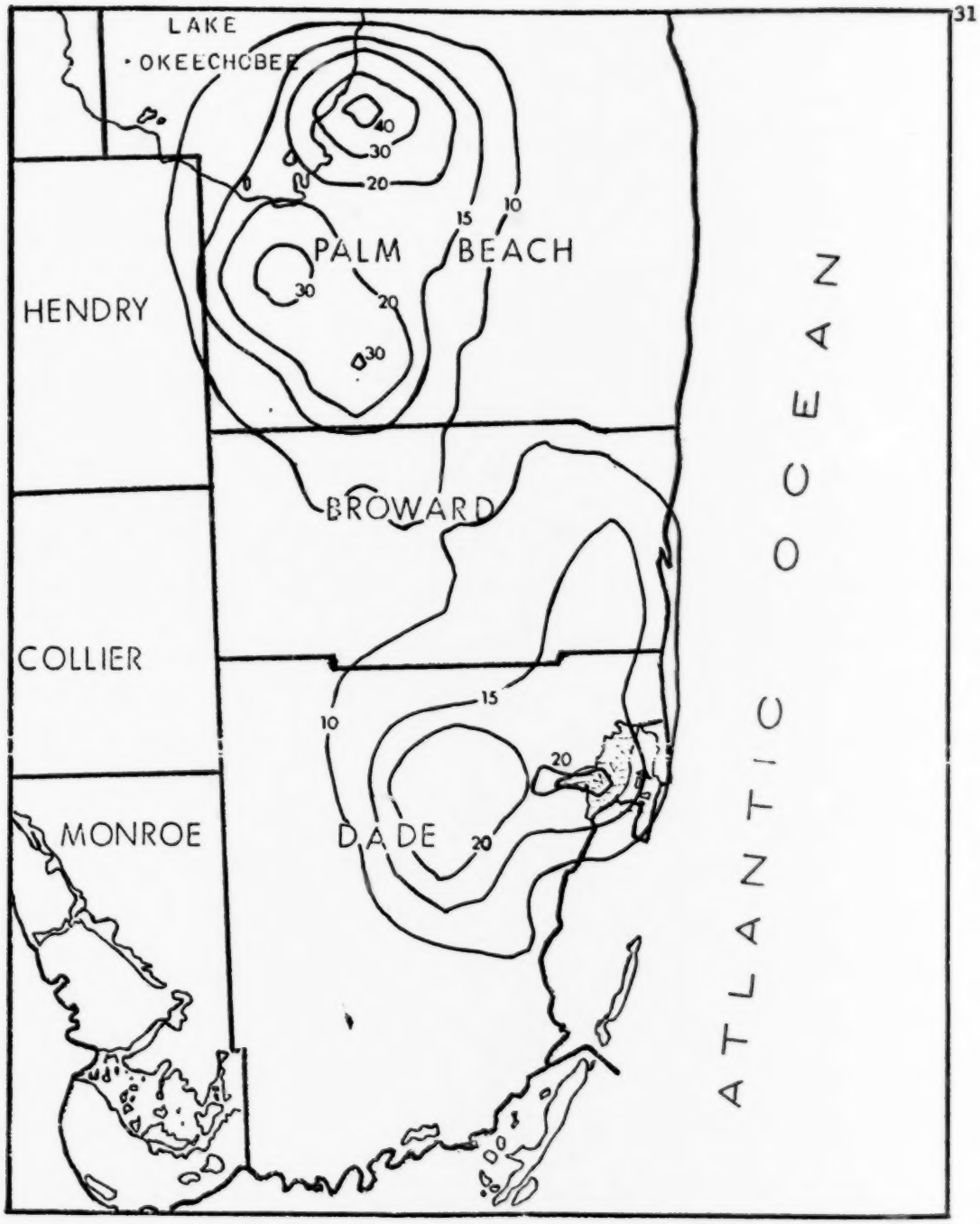


FIGURE 11. COMPUTED RELATIVE CONCENTRATIONS OF CARBON MONOXIDE (WINTER AVERAGE).



SCALE IN KILOMETERS

0 5 10 20 30 40 50 100

FIGURE 12. COMPUTED RELATIVE CONCENTRATIONS OF SUSPENDED PARTICULATES (SUMMER AVERAGE).

EVALUATION OF URBAN FACTORS

INTRODUCTION

The Clean Air Act calls for the designation of air quality control regions based on "jurisdictional boundaries, urban-industrial concentrations, and other factors" to provide an inter-governmental system for the prevention and control of air pollution. The designation of air quality control regions must also be based on a consideration of existing cooperative regional arrangements, population concentrations, location of industry, and patterns and rates of urban growth. The following discussion or urban factors will present these considerations as they apply to the Metropolitan Miami area.

POPULATION DISTRIBUTION

Human activity in its many forms is the basic cause of air pollution. Thus, existing and potential air pollution problems may be related to geographic areas by studying present and projected population statistics for those areas. Dade County is the southeasternmost county in the State of Florida. The Metropolitan Miami urban complex is located in northeast Dade County, 14 miles south of the Broward County border. Palm Beach County lies directly to the north of Broward County. Together, these three counties possess the most intensely developed areas and the bulk of the population in southern Florida.

Figure 13 provides an indication of the locations of the largest cities in the study area. From this figure it is apparent that the intensely urbanized areas in Broward, Dade, and Palm Beach Counties are located along the coast. Since only the eastern-most portions of these counties are intensely developed at present, the great majority of their land areas are either lightly developed or undeveloped. Further, the Glades area covers the western two-thirds of Broward, Dade, and Palm Beach Counties. The glade and marsh lands, together with water conservation areas, national park land and Indian reservations, make much of the presently undeveloped areas within these counties undevelopable. Similarly, the counties located directly to the north and west of Dade, Broward and Palm Beach Counties, which presently possess a low degree of development, are undevelopable over much of their land area.

The major cities in Dade County are Miami, Miami Beach, North Miami, North Miami Beach, Hialeah and Coral Gables. Homestead, located in south-central Dade County, is a center of sizeable population. In Broward County, the major cities are Fort Lauderdale, Hollywood, Pompano Beach and Hallandale. The major cities of Palm Beach County are West Palm Beach, Boca Raton, Lake Worth, Riviera Beach, Del Ray Beach and Poynton Beach, all located along the coast. Belle Galde, located

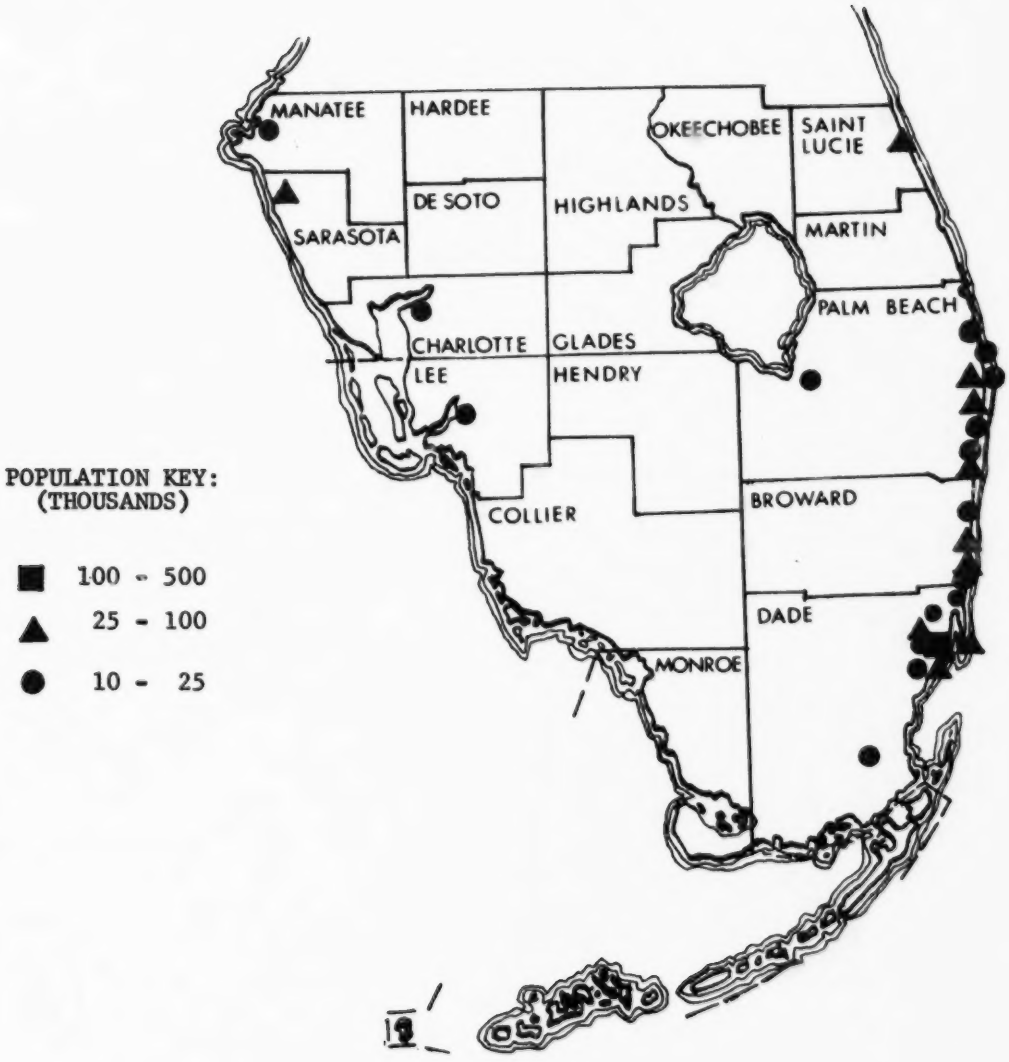


FIGURE 13. MAJOR CITIES IN SOUTHERN FLORIDA.

on Lake Okeechobee in west Palm Beach County, is another city of significant size. The estimated 1969 populations for the largest of these cities - Miami, Fort Lauderdale, Hollywood and West Palm Beach - are 320,000, 132,000, 88,000 and 63,900 persons, respectively.

Table IV presents existing and projected population for the several counties in southern Florida. The data indicates that Dade, whose 1970 population is estimated as 1,290,000 persons, is by far the largest County in the study area. Dade is also the largest County in Florida and contains the second largest metropolitan area in the southeast. During the decade of the 50's, Dade County was the fastest growing metropolitan area in the country. Broward County, the second most populated in the study area, contains 670,000 persons, followed by Palm Beach County with 372,000 persons. Present population densities by county are presented in Figure 14. As expected, Dade, Broward and Palm Beach - in that order - are the most densely populated counties in southern Florida. The counties bordering these three counties have populations and population densities ranging from low to very low.

Projected levels of population presented in Table IV indicate that Broward County will add 220,000 persons by 1975, while Dade County will add 196,000 residents.

TABLE IV.

PRESENT AND PROJECTED POPULATION DATA AND
MANUFACTURING EMPLOYMENT BY JURISDICTION

County	Land Area ($Mi.^2$)	1969 Estimated Population [1]	1969 Population Density (Persons/$Mi.^2$)	1975 Projected Population [2]	1975 Population Density (Persons/$Mi.^2$)	Additional Residents 1969-1975	Additional Residents/$Mi.^2$ 1969-1975	Per Cent Growth 1969-1975	Estimate 1963 Manufacturing Employment [3]	1963 Manufacturing Employment Density (Persons/$Mi.^2$)
Broward	1,219	670,000*	500	890,000*	731	220,000	181	32.8	9,750	8
Charlotte	703	21,400	30	33,700	48	12,300	18	57.5	138	Neg.
Collier	2,006	33,000	16	48,800	24	15,800	8	47.9	156	Neg.
Dade	2,042	1,290,000**	572	1,486,000**	650	196,000	96	15.2	43,245	21
De Soto	648	13,600	21	15,100	23	1,500	2	11.0	316	Neg.
Glades	753	3,800	5	4,600	6	800	1	21.0	NA	NA
Hardee	629	15,000	24	16,900	26	1,900	3	12.7	255	Neg.
Hendry	1,187	12,400	10	14,000	12	1,600	1	12.9	478	Neg.
Highlands	1,043	26,000	25	29,800	29	3,800	4	14.6	161	Neg.
Lee	785	87,500	111	113,200	144	25,700	33	29.4	909	1
Manatee	739	84,900	115	100,600	136	15,700	21	18.5	2,021	3
Martin	556	24,200	44	32,200	58	8,000	14	33.1	248	Neg.
Monroe	1,034	62,500	60	79,000	76	16,500	16	26.4	396	Neg.
Okeechobee	777	10,000	13	12,500	16	2,500	3	25.0	166	Neg.
Palm Beach	2,023	372,000***	154	451,000***	194	79,000	39	21.2	11,869	6
Saint Lucie	583	50,600	87	58,900	101	8,300	14	16.4	879	2
Sarasota	587	109,000	186	131,600	224	22,600	38	20.7	2,786	5

1. Bureau of Economic and Business Research, College of Business Administration, University of Florida, for July 1, 1969.
2. Bureau of Economic and Business Research, College of Business Administration, University of Florida, for July 1, 1975.
3. Commercial Atlas and Marketing Guide, 100th Edition, Rand McNally & Co., 1969.

*Broward County Area Planning Board.
**Metropolitan Dade County Planning Department.
***Area Planning Board of Palm Beach County.
Note: Present Population Estimates for Broward, Dade, and Palm Beach Counties Are for the Year 1970.
NA : Not Available
Neg.: Negligible

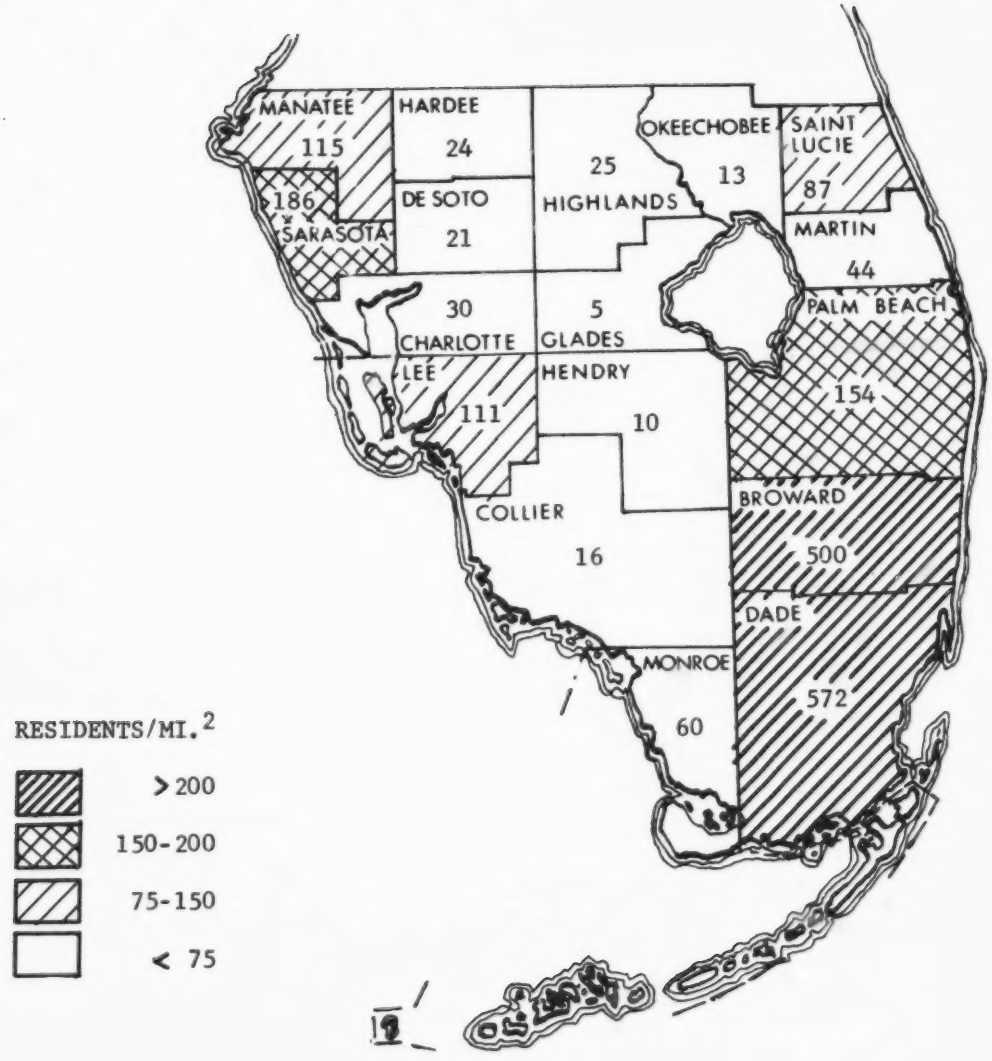


FIG. 14. PRESENT POPULATION DENSITIES IN SOUTHERN FLORIDA.

Palm Beach County will gain 79,000 additional residents during this period. During this same period the five bordering counties- Collier, Glades, Hendry, Martin and Monroe - will add a total of only 42,700 new residents. This disparity in growth is indicated in Figure 15.

It is anticipated that the bulk of the added growth in Dade, Broward and Palm Beach Counties will occur in and near the presently urbanized or non-urban, but developable, areas. Thus, the marked difference in intensity of population settlement between the eastern and western portions of these counties will increase. Though development is prohibited in much of the western portions of these counties, population will be forced westward to areas not readily developable at present due to the need for additional space. Much of the land in these counties, while not readily suited to urban development, has been and will continue to be important agriculturally.

It is expected that the Fort Lauderdale and Miami urban areas will grow toward one another due to the northern pull Fort Lauderdale is presently exerting on urban form in Dade County. Growth in Dade County will also be substantial along the corridor stretching from Miami to Homestead in southern Dade County. Notwithstanding the large population increases projected for southeastern Florida, a vast expanse of unpopulated area will remain between the populated areas on the east and west coasts.

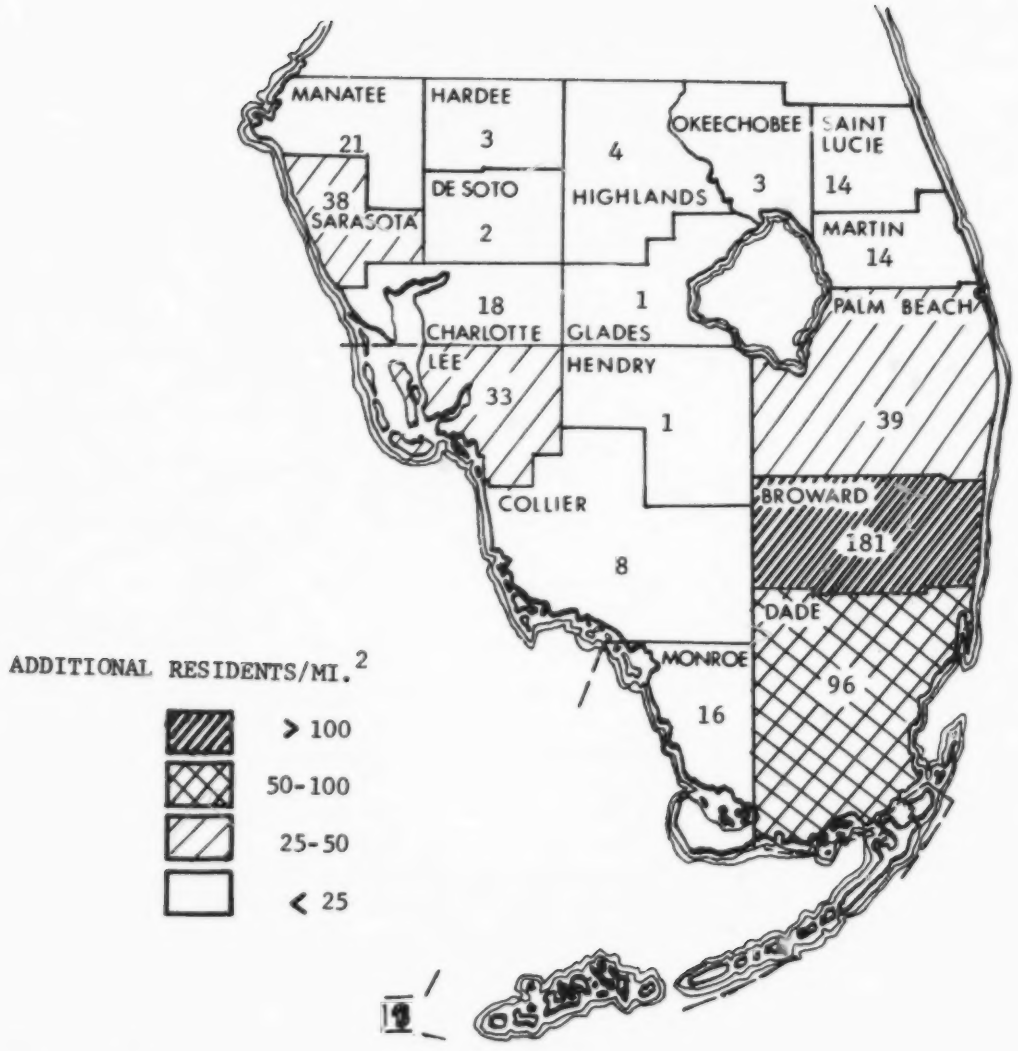


FIG. 15. ADDITIONAL RESIDENTS PER SQUARE MILE, 1969-1975.

MANUFACTURING ACTIVITY

The location of manufacturing activity is helpful in determining the size of an air quality control region since industrial sources are often substantial contributors of air pollutant emissions. Manufacturing employment statistics and land use information have been used to provide an indication of the geographic location and extent of industrial activity in the southern Florida area.

Table IV and Figure 16 provide information on the distribution of manufacturing employment in southern Florida, based on 1963 data. These data indicate that manufacturing employees are by far most numerous in Dade, Palm Beach, and Broward Counties, in that order. The bordering counties have little industry, as evidenced by the low numbers of manufacturing employees within them.

Within Dade, Palm Beach and Broward Counties, most of the industry is, as expected, located in the presently urbanized areas - those areas near the coast. Dade County's industry is chiefly light (little polluting potential). It is primarily located in north-east Dade County. The major manufacturing activities are diversified and include apparel and other textile products, transportation equipment, fabricated metal products, food and kindred products and miscellaneous durable and non-durable goods. Greatest growth in manufacturing is expected

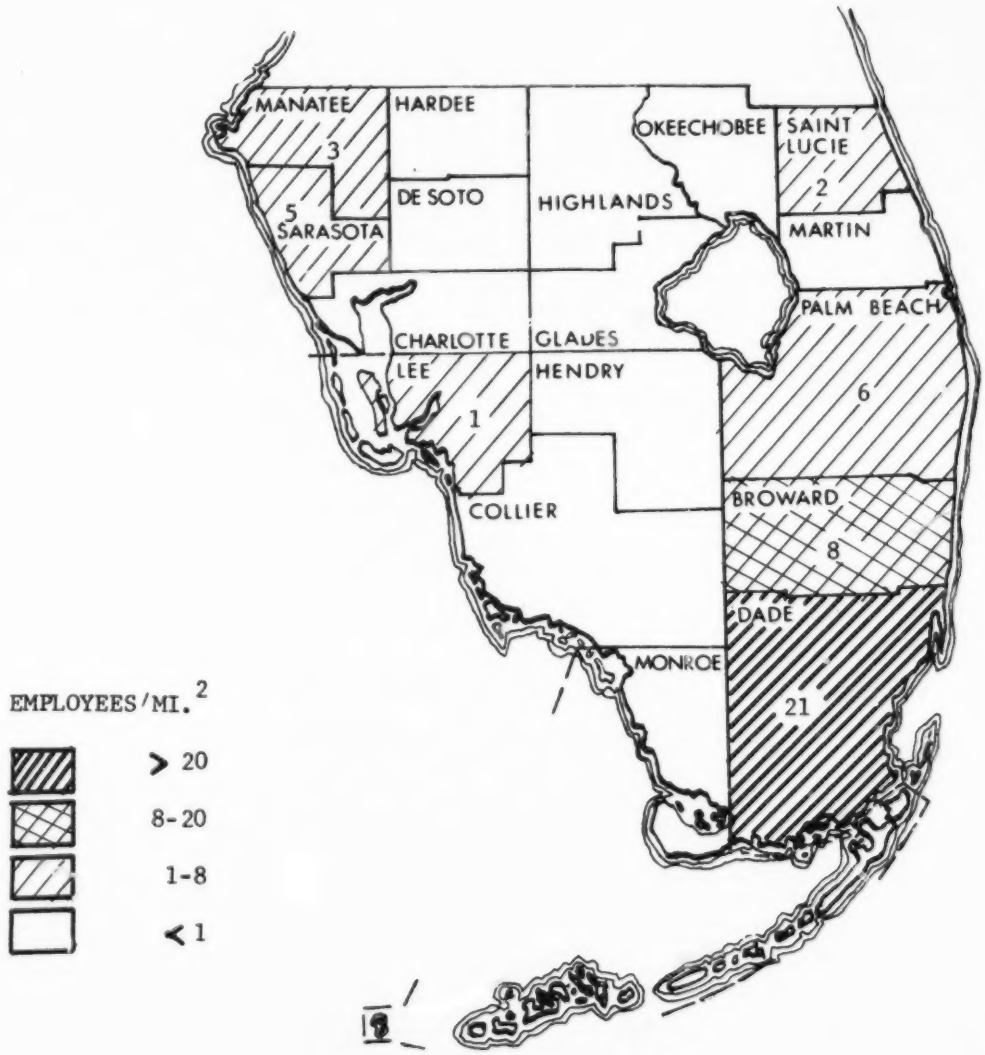


FIG. 16. 1963 MANUFACTURING EMPLOYMENT DENSITIES.

to occur in textile products, transportation equipment, machinery and printing and publishing.

Industrial activity in Palm Beach County is increasing substantially, as gauged by the increase in manufacturing employees from 1960 to 1968. In this same period, manufacturing employment has increased in its proportion of the total work force from 9% to 14%. In Palm Beach County the manufacture of food and kindred products; stone, clay and glass products; lumber and wood products; fabricated metals; electronics equipment; and sugar milling, are of major significance.

In 1957, Broward County was second to Dade County in Florida in the acquisition of new and diversified industry and the employment of manufacturing employees. The major activities in the County are engaged in the production of electrical and non-electrical machinery; stone, clay, and glass products; lumber products; and furniture, textile and leather products.

Generally, tourism has in the past been the most important source of income in the southeastern Florida area, and will continue as such. Manufacturing and research oriented activities are expected, however, to play a more important role in the future. While only a comparatively small percentage of non-agricultural jobs are in manufacturing, and only a small percentage of land is zoned for industry, an industrial build-up in this region is inevitable.

EXISTING REGIONAL ARRANGEMENTS

The geographic extent of regional planning commissions, councils of local governments, State-defined planning and economic development districts, and region-wide statistical data-gathering bases is an important consideration affecting the selection of air quality control region boundaries. The designation of a region compatible with these existing regional arrangements is desirable since the implementation of a regional air pollution control effort is dependent upon cooperation at the various levels of government. Further, region-wide planning programs may be capable of providing assistance in the development of air quality standards and a plan to implement those standards.

The concept of Standard Metropolitan Statistical Areas (SMSA's) has been developed to meet the need for the presentation of general-purpose statistics by agencies of the Federal Government, and by State and local governments. Each SMSA includes at least one city of 50,000 inhabitants, the county in which that city lies, and adjacent counties which are found to be metropolitan in character and economically and socially integrated with the county of the central city. Objective criteria of a quantitative character have been established to determine the existence of such multi-jurisdictional interdependency. On these bases, Dade, Broward and Palm Beach Counties have been designated as individual SMSA's.

At the present time only metropolitan, or county-wide planning is conducted in the study area. Such county-wide agencies exist in Broward, Dade and Palm Beach Counties. There are at present, however, no regional, or multi-county, planning agencies operative in southeastern Florida. Although no formal joint planning is carried out between Dade, Broward and Palm Beach Counties, they nevertheless maintain a close working relationship.

In July, 1969, the Florida State Planning and Budget Commission adopted a Resolution which recommended boundaries for regional planning and development districts.* This was done by the Commission on the basis of its awareness that comprehensive development planning is a function which has benefited in those areas which have conducted planning on a multi-jurisdictional basis. The district boundaries recommended by the Commission for southern Florida are shown in Figure 17. The boundaries shown were felt to be most consistent with State-wide comprehensive planning. These boundaries were developed after a consideration of regional economic patterns, general population trends, existing State agency administrative districts, existing planning region boundaries, and other substate special purpose districts. In southeastern Florida, Dade, Broward, Monroe and Palm Beach Counties have been included within a single district.

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*Recommendation for Regional Planning and Development of District Boundaries. Florida Office of State Planning, August 1968.

FIGURE 17. REGIONAL PLANNING AND DEVELOPMENT DISTRICT BOUNDARIES.

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The State Planning and Budget Commission recommended the planning and development districts in furtherance of its efforts to encourage and cooperate with local governments in their attempts to improve the quality of governmental service through regional planning. In addition, in adopting the Resolution the Commission's intent was to encourage local officials to consider the recommended boundaries when contemplating the establishment of new regional planning and development districts or adjusting the boundaries of existing districts.

At the same time that the Planning and Budget Commission adopted regional planning and development districts, it adopted boundaries for State planning and statistical areas whose use was intended to enhance the development of statistics, plans, and programs within Florida. The planning and statistical area delineated for southeastern Florida includes Broward, Dade, Monroe and Palm Beach Counties. This area is coterminous with the recommended regional planning and development district.

EXISTING AIR POLLUTION CONTROL PROGRAMS

The Florida Air and Water Pollution Control Act (Chapter 403 of the Florida Statutes) was passed by the Florida Legislature in 1967. The Act created the Florida Air and Water Pollution Control Commission and provided for the adoption of rules and regulations. Among other things, the Act described requirements

to be met by local air pollution control programs. Section 26 of Florida Statute 69-106 was passed by the Florida State Legislature and became effective in mid-1969. Section 26 created the Department of Air and Water Pollution Control as an independent State agency. The Department is headed by the Air and Water Pollution Control Board (which supersedes the Pollution Control Commission). The Board has promulgated rules and regulations providing for specific limitations on visible emissions, particulate and fluoride emissions.

The Department of Air and Water Pollution Control has jurisdiction throughout the State except in the jurisdiction of local agencies which have been certified by the Department as being adequate to control pollution and/or in the jurisdictions of those local agencies which need not be certified by the Department because they have acts that are stricter than the State's. At present, no local programs have been certified and no local programs have been exempted from certification.

Air pollution control activities in Dade County are conducted by the Metropolitan Dade County Pollution Control Department. An ordinance was initially enacted in 1963, and amended in 1969, by the Dade County Board of Commissioners. The Ordinance created the Pollution Control Hearing Board and provides for its powers, duties, and functions. The Ordinance further provides for the powers and duties of the Pollution Control Officer and for the promulgation of

rules and regulations by the County Commissioners. Present rules and regulations provide for limitations on visible emissions, particulate matter, and sulfur dioxide.

The Palm Beach County Health Department has been designated as an interim agent of the State of Florida Department of Air and Water Pollution Control. The County Health Department's legal authority is based on the enforcement of the Rules and Regulations of the State Department of Air and Water Pollution Control since no legal enabling authority has been granted to the County by the State Legislature.

State Senate Bill No. 1326, which became law on June 19,1963, authorizes the Board of County Commissioners of Broward County to control air pollution. The air pollution control efforts are made through the County Health Department.

THE PROPOSED REGION

Subject to the schedule consultation, the Secretary, Department of Health, Education, and Welfare, proposes to designate an air quality control region for the Miami, Florida intrastate urban area. The proposed Region consists of the following jurisdictions in the State of Florida:

Broward County

Dade County

Palm Beach County

As so proposed, the Metropolitan Miami Region would consist of the territorial area encompassed by the outermost boundaries of the above jurisdictions and the territorial area of all municipalities located therein and as defined in Section 302(f) of the Clean Air Act, as amended (42 U.S.C. 1857h(f)). The boundaries of the proposed Region are shown in Figure 18.

FIGURE 18. PROPOSED MIAMI INTRASTATE AIR QUALITY CONTROL REGION.

DISCUSSION OF PROPOSAL

To implement a successful air resource management program, an air quality control region should be large enough to encompass most air pollution sources as well as most people and property affected by those sources. The boundaries should also include those locations were present development creates, or where projected urbanization and industrialization will create, significant air pollution problems. Finally, the region should be compatible with or hopefully even foster unified and cooperative governmental administration of the air resource. The proposed Metropolitan Miami Intrastate Air Quality Control Region was designed to satisfy, in the best way, these requirements.

Preliminary investigations indicated that the emissions inventory, if restricted to Broward, Dade and Palm Beach Counties, would encompass virtually all of the major air pollutant sources and source areas in southeastern Florida. The results of that inventory indicated the the major pollutant source-areas are located in the eastern, and particularly the coastal portions of the 3-county survey area; that is, in the urban corridor stretching roughly from Homestead northward to West Palm Beach. As a result, a readily identifiable relationship of the counties in the survey area to an air pollution problem involving additional counties, was not evident. The possible exception to this is western Palm Beach where the milling and open burning of sugarcane may affect air quality in Hendry County to the west and Martin County to the north.

Topography is not a factor affecting air pollution in southeastern Florida. Meteorological factors in the area tend to minimize air pollution. Air pollution in southeastern Florida is not as serious at the present time as in other large metropolitan areas. There exists, however, air quality information which indicates that pollutant concentrations in portions of Dade and Palm Beach Counties are substantially greater than the background or natural levels expected for the area. Information obtained through the use of the meteorological diffusion model indicates that the air quality within large portions of Broward, Dade and Palm Beach Counties is affected by the total 3-county pollutant source-complex. The general conclusion drawn from the evaluation of engineering factors is that the Region should include as a minimum, the three counties over which the air pollutants were inventoried. In such a 3-county Region, it would be necessary to institute an air pollution control program to enhance, and in areas where air quality is presently acceptable to protect the air resource.

Broward, Dade and Palm Beach Counties possess, by far, the bulk of the population and manufacturing activity in Southern Florida. Because of the concentration of population along the coastal areas of these counties, a very high percentage of their populations are classified as urban. In contrast to the intense coastal urban development, the western portions of these three counties are either not readily developable or undevelopable. Thus, a buffer zone is provided between the population centers and the lightly developed counties of Monroe, Collier, Hendry, and Glades to the west.

Future growth will heighten the existing disparity in intensity of development of Broward, Dade and Palm Beach Counties and the counties to their north and west. The bulk of the added growth in the three counties proposed for the Region will occur in the presently urbanized or non-urban, developable areas. Though development is prohibited in much of the western portions of these three counties, population will be forced westward to areas not readily developable as the need for additional space arises. There does not appear to be, however, the prospect that urban growth corridors will connect the present coastal cities of Dade, Broward and Palm Beach Counties to urban areas in the counties to the west.

At the present time, no regional or multi-county planning agencies are operative in Southeastern Florida. County-wide planning exists in Dade, Broward and Palm Beach Counties, which are individual Standard Metropolitan Statistical Areas. In 1969, the Florida Planning and Budget Commission adopted a Resolution which recommended boundaries for region planning and development districts. The recommended district in Southeastern Florida includes Dade, Broward, Monroe and Palm Beach Counties. These boundaries were developed after a consideration of regional economic patterns, general population trends and existing planning region boundaries. The Commission's intent in adopting the Resolution was to encourage local officials to consider the recommended boundaries when contemplating the establishment of new regional planning and

development districts or when adjusting boundaries of existing districts.

The urban factors evaluation indicates that the Region should include a minimum of Broward, Dade and Palm Beach Counties. This agrees with the conclusion reached in the evaluation of technical factors. It was not felt that sufficient evidence exists to warrant the inclusion of additional counties to the 3-county proposal at the present time. The designation of this three-county region should serve to encourage the most effective use of State and local resources toward the solution of the problem of air pollution.

Because of the nature of the problem of air pollution, there is always the possibility that pollutant transport into or out of an established region may exist. An air quality control region can never be completely self-contained with respect to sources and receptors of air pollution. The three-county Region proposed by the Federal Government is considered to be the most cohesive and yet inclusive area within which an effective regional effort can be mounted to prevent and control air pollution.

Official designation of the Region will follow the formal Consultation with appropriate State and local officials, and after due consideration of comments presented for the record at the Consultation or of those written comments received by the Commissioner of the National Air Pollution Control Administration.